




UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/628,925	07/28/2003	Lee M. Nicholson	YOR920030173US1	7501
7590 06/15/2005			EXAMINER	
Paul D. Greeley, Esq. Ohlandt, Greeley, Ruggiero & Perle, L.L.P. 10th Floor One Landmark Square Stamford, CT 06901-2682			VU, HUNG K	
			ART UNIT	PAPER NUMBER
			2811	

DATE MAILED: 06/15/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/628,925	NICHOLSON ET AL. 	
	Examiner	Art Unit	
	Hung Vu	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 April 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 7-9 and 15-31 is/are rejected.
- 7) ☒ Claim(s) 6 and 10-14 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-5, 7-9, 15-19, 21 and 25-31 are rejected under 35 U.S.C. 102(b) as being anticipated by Yew et al. (PN 6,265,780).

Yew et al. discloses, as shown in Figure 2E, an electrical interconnect structure on a substrate, comprising:

- a first low k or ultra low k dielectric layer (204,212);
- a low k CMP protective layer (206,214) disposed on the first low k dielectric layer;
- a hardmask/CMP polish stop layer (208,216).

With regard to claims 2 and 5, the terms “CVD” and “spin-on low k” are method recitations in a device claimed. “[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.” *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Art Unit: 2811

With regard to claim 3, Yew et al. discloses the first low k dielectric layer is comprised of an organic dielectric material.

With regard to claim 4, Yew et al. discloses the first low k dielectric layer is selected from the group consisting of: SiLK.

With regard to claim 7, it is inherent that the low k CMP protective layer is comprised a material (FSG, HSQ) with a low CMP polish rate that can be directly polished without scratching or producing other defects.

With regard to claim 8, Yew et al. discloses the low k CMP protective layer (FSG, HSQ) has a dielectric constant of from about 2.2 to about 3.5.

With regard to claim 9, it is inherent that the low k CMP protective layer is inert to chemicals contained in CMP polish slurries.

With regard to claim 15, Yew et al. discloses the CMP protective layer is comprised of a material selected from the group consisting of silsesquioxane (HSQ).

With regard to claim 16, Yew et al. discloses the material has a low dielectric constant and it is inherent that the material has a low CMP polish rate.

Art Unit: 2811

With regard to claim 17, it is inherent that the hardmask/CMP polish stop layer is a conventional hardmask/CMP polish stop layer.

With regard to claim 18, Yew et al. discloses the hardmask/CMP polish stop layer is comprised of silicon nitride.

With regard to claim 19, Yew et al. discloses the first low-k dielectric is an organic dielectric and the low-k CMP protective layer is an inorganic material.

With regard to claim 21, Yew et al. discloses the first low k dielectric is a stack of dielectric containing an embedded etch stop (208).

With regard to claim 25, Yew et al. discloses the structure further comprising a stack of dielectric layers on the substrate, the stack including at least the first low-k dielectric layer and the low k CMP protective layer.

With regard to claim 26, Yew et al. discloses the structure further comprising: a plurality of patterned metal conductors (224,226) formed within the stack of the first low-k dielectric layer and the low-k CMP protective layer.

With regard to claim 27, Yew et al. discloses at least one of the patterned metal conductors (224) is an electrical via.

With regard to claim 28, Yew et al. discloses at least one of the patterned metal conductors (224) is a line connected to the via.

With regard to claim 29, Yew et al. discloses the structure further comprising: a single level of patterned metal conductors (224,226) formed with the stack of dielectric layers on the substrate.

With regard to claim 30, Yew et al. discloses the pattern metal conductor (224,226) is a line.

With regard to claim 31, Yew et al. discloses the pattern metal conductor (224) is a via

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 20 and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yew et al. (PN 6,265,780) in view of Chooi et al. (PN 6,683,002).

With regard to claim 20, Yew et al. discloses the claimed invention including the interconnect structure as recited in the rejection above. Yew et al. further discloses the low k dielectric layer is SiLK. Yew et al. does not disclose the low k dielectric layer is porous. However, Chooi et al. discloses the low k dielectric layer (16,18) is SiLK or porous. Note Col. 3, lines 1-20 of Chooi et

Art Unit: 2811

al.. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the low k dielectric layer of Yew et al. being porous, such as taught by Chooi et al. in order to further reduce the dielectric constant of the low k dielectric layer.

With regard to claims 22 and 23, Yew et al. discloses the claimed invention including the interconnect structure as recited in the rejection above. Yew et al. does not teach the thickness of the first low k dielectric layer and the low k CMP protective layer, as that claimed by Applicants. However, Chooi et al. discloses the first low k dielectric layer (16) and the low k CMP protective layer (18) having the thickness as claimed. Note Figures 5 and 8B, and Col. 3, lines 35-69 of Chooi et al.. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the first low k dielectric layer and the low k CMP protective layer of Yew et al. having the thickness, such as taught by Chooi et al. since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

With regard to claim 24, Yew et al. discloses the claimed invention including the interconnect structure as recited in the rejection above. Yew et al. further discloses the substrate is a semiconductor wafer. Yew et al. does not teach the substrate having an adhesion promoter layer formed thereon. However, Chooi et al. discloses a substrate having an adhesion promoter layer formed thereon. Note Figures 5 and 8B of Chooi et al.. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the substrate of Yew

Art Unit: 2811

et al. having an adhesion promoter layer thereon, such as taught by Chooi et al. in order to provide better adhesion between the substrate and the low k dielectric layer.

Allowable Subject Matter

3. Claims 6 and 10-14 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

4. Applicant's arguments filed 04/01/05 have been fully considered but they are not persuasive.

It is argued, at page 8 of the Remarks, that Yew et al. discloses the protective layer does on the etch stop layer, not directly on the first dielectric layer. This argument is not convincing because Yew et al. discloses the protective layer (206, 214) directly on the first dielectric layer (204,212). Note that the term “directly on” does not necessarily mean “in directly contact with”

It is argued, at page 9 of the Remarks, that Yew et al. discloses layer 214 as being “a high-K inorganic dielectric material” and layer 216, being “a second photoresist” and neither of them being a low k dielectric material. This argument is not convincing because Applicant does not specifically claim how low is low, therefore, layers 214 and 216 still meet the claimed language.

It is argued, at page 9 of the Remarks, that Yew et al. discloses layer 206 is an etch stop layer, not a protective layer. This argument is not convincing because layer 206 can function as a

Art Unit: 2811

protective layer. Note that claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danley*, 120 USPQ 528, 531 (CCPA 1959).

"Apparatus claims cover what a device is, not what a device does ." (emphasis in original)

Hewlett - Packard Co . v. Bausch & Lomb Inc., 15 USPQ2d 1525, 1528 (Fed. Cir. 1990).

It is argued, at page 10 of the Remarks, that the protective layer is a CMP protective layer, not an etch protective layer. This argument is not convincing because etch protective layer can function as a protective layer. Note that claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. Further, "[e]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

It is argued, at page 10 of the Remarks, that Yew et al. discloses the protective layer is a high dielectric constant material, not a low k dielectric material. This argument is not convincing because Applicant does not specifically claim how low is low, the protective layer still meets the claimed language.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on

combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hung K. Vu whose telephone number is (571) 272-1666. The examiner can normally be reached on Mon-Thurs 6:00-3:30, alternate Friday 7:00-3:30, Eastern Time.

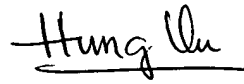
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on (571) 272-1732. The Central Fax Number for the organization where this application or proceeding is assigned is (703) 872-9306.

Art Unit: 2811

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Vu

June 10, 2005

A handwritten signature in black ink, appearing to read "Hung Vu", with a horizontal line drawn underneath the name.

Hung Vu

Primary Examiner